Prestwich (J.), F.R.S. Geology: Chemical, Physical, and Stratigraphical. Vol. II. 8vo. *Oxford* 1888. The Author.

Sclater (P. L.), F.R.S., and W. H. Hudson. Argentine Ornithology: a Descriptive Catalogue of the Birds of the Argentine Republic. Vol. 1. 8vo. *London* 1888. The Authors.

March 8, 1888.

Professor G. G. STOKES, D.C.L., President, in the Chair.

The Presents received were laid on the table, and thanks ordered for them.

The following Papers were read:—

I. "On some New and Typical Micro-organisms obtained from Water and Soil." By GRACE C. FRANKLAND and PERCY F. FRANKLAND, Ph.D., B.Sc. (Lond.), F.C.S., F.I.C., Assoc. Roy. Sch. of Mines. Communicated by Professor T. H. HUXLEY, F.R.S. Received February 15, 1888.

(Abstract.)

In a previous communication,* the authors have given a detailed description of a number of micro-organisms—Bacilli and Micrococci—which they had obtained in the course of investigations on the distribution of micro-organisms in the atmosphere. The present paper deals similarly with a number of typical and characteristic micro-organisms which they have derived from various natural waters.

The authors refer to the forms which have been obtained from water by previous observers, more especially to the "peach-coloured bacterium," the "*Cladothrix dichotoma*," and the "*Crenothrix kühniana*," as well as to others which have been more recently isolated by means of the method of gelatine-plate cultivation.

The authors point out the striking difference between the aërial and aquatic micro-organisms, micrococci being the predominant forms amongst the former, whilst bacillar forms are almost exclusively present in water. In fact all the aquatic forms described are bacilli.

* "Studies on some New Micro-organisms obtained from Air," 'Phil. Trans.,' B, vol. 178, p. 257.

The chemical action which the several micro-organisms described exert upon certain solutions containing salts of ammonia and of nitric acid respectively has been investigated by one of the authors, with the result that whilst none of the forms in question were found to oxidise ammonia either to nitrous or nitric acids, several of them were found to exert a powerfully reducing action on nitrates, converting the latter into nitrites, others were without any action on the nitric acid, and others again caused the disappearance of an appreciable proportion of the nitric acid without production of a corresponding amount of nitrite. The authors point out that these differences in the behaviour of micro-organisms when introduced into solutions containing nitrates are capable of furnishing very important data for distinguishing between forms which otherwise present very close resemblance. Thus *Bacillus subtilis* and *Bacillus cereus*, previously described by them as closely resembling each other, can be easily distinguished by the behaviour which they respectively exhibit towards the nitrate-solution, for whilst both grow luxuriantly in this medium, the *Bacillus subtilis* has no action on the nitric acid which can be quantitatively recovered, the *Bacillus cereus*, on the other hand, powerfully reduces the nitrate with formation of nitrite.

The nitrate-solution employed for the purpose of these experiments contained potassium phosphate, magnesium sulphate, calcium chloride, calcium nitrate, invert sugar, peptone, and an excess of calcium carbonate.

The following is a brief account of the descriptions given of the various micro-organisms :—

Bacillus arborescens.—This is seen under a high power ($\times$ 1000 diameters) to be a slender bacillus giving rise to wavy threads, sometimes of considerable length. No spores were observed. In drop cultivations it is seen to be vibratory.

On gelatine plates it produces highly characteristic colonies. Under a low power ($\times$ 100 diameters) the centre is seen to consist of a thin axial stem with root-like branches from each of its two extremities, this stem thickens as growth proceeds, and the ramified extremities become so largely developed that the whole colony has the appearance of a wheat sheaf. The plate is slowly liquefied, and the periphery of the colony extends irregularly and to some distance from the centre, over the surface of the gelatine, giving rise to beautiful iridescent colours.

On potatoes it produces a fine deep-coloured orange pigment.

On nitrates it has no action in the solution employed.

Bacillus aquatilis.—This is a slender bacillus also giving rise to wavy threads. No spores were observed, and the individual bacilli are seen in drop cultivations to exhibit only an oscillatory motion.

On gelatine plates the contour of the colony becomes more and

more irregular as they approach the surface; when liquefaction of the gelatine commences, which only takes place excessively slowly, convoluted bands of threads are seen to extend from the centre towards the periphery.

It grows with great difficulty in all the media employed with the exception of the aqueous solution, in which it grows abundantly, but does not convert the nitrate into nitrite.

Bacillus liquidus.—This is a short fat bacillus of very variable dimensions. In drop cultivations they are seen usually hanging together in pairs, and exhibit great motility.

It liquefies the gelatine, rapidly producing large circular depressions with almost clear contents on gelatine plates.

It produces a smooth shining expansion on agar-agar, and on potatoes a thick flesh-coloured pigment.

It reduces the nitrate powerfully in the aqueous solution employed.

Bacillus vermicularis.—This is a large bacillus with rounded ends, giving rise to extensive vermiform threads. It produces fine oval spores. In drop crystallisations it exhibits oscillatory movement only.

It powerfully reduces nitrates to nitrites.

Bacillus nubilus.—This is a fine slender bacillus, which gives rise to wavy threads. No spores were observed. In drop cultivations the isolated bacilli exhibit violent circular movements with but little motion of translation.

On gelatine plates the growth is very characteristic, nothing being visible but patches of cloudy expansions with, in some cases, a very faintly-defined centre. The gelatine rapidly becomes softened, and liquefaction soon follows.

In gelatine-tubes the same characteristic cloudy appearance is produced. Its growth in the aqueous solution described results in the reduction of a very small proportion of the nitrate to nitrite.

Bacillus ramosus.—This is a large bacillus much resembling *B. subtilis*, giving rise to long threads and spores, which are, however, rounder in shape than those of the latter organism. In drop cultivations the isolated bacilli exhibit very slight oscillatory movement.

The colonies on the gelatine plates are seen to consist of a cloudy centre with tangled root-like branches which extend in every direction. Later liquefaction of the gelatine takes place.

In gelatine the whole of the tube becomes impregnated with fluffy ramifications, later liquefaction takes place, and a tough pellicle forms on the surface.

When grown on potatoes, it forms a dry continuous surface expansion which is almost quite white.

It exerts a powerfully reducing action on nitrates in the solution employed.

Bacillus aurantiacus.—This is a short fat bacillus of very variable dimensions. No spores were observed. In drop cultivations the isolated bacilli are seen to be motile.

On gelatine plates it produces bright orange pin-heads, but on potatoes it gives rise to a magnificent brilliant red-orange pigment, which does not however extend far from the point of inoculation.

It reduces the nitrates to nitrites only very slightly in the solution employed.

Bacillus viscosus.—This is a short bacillus about three or four times as long as broad, occurring mostly in pairs. No spores were observed. It is exceedingly motile.

It very rapidly liquefies the gelatine, rendering it very viscid and colouring it green. On agar-agar the whole surface quickly assumes a green tint.

No reduction of the nitric acid takes place when grown in the aqueous solution described.

Bacillus violaceus.—This is a bacillus varying in thickness, sometimes appearing short and stout, but when grown on agar assuming a far more slender appearance; it also gives rise to short threads. Spore formation was observed. In drop cultivations they are seen to be motile, the movement being, however, principally vibratory and rotatory.

It produces on agar-agar a fine dark violet expansion.

It powerfully reduces nitrates to nitrites when grown in the aqueous solution employed.

Bacillus diffusus.—A fine slender bacillus recurring frequently in pairs, and giving rise also occasionally to long undulating threads. No spores were observed. In drop cultivations the bacilli are seen to execute vigorous oscillatory and rotatory movements, but do not traverse the field of the microscope.

On gelatine plates the colonies give rise on reaching the surface to a halo, which, extending from the centre, spreads to a considerable distance round, and is composed of a very thin and characteristically mottled expansion.

It slightly reduces the nitrates to nitrites when grown in the aqueous solution employed.

Bacillus candicans.—This bacillus varies very much in form in one and the same cultivation and still more in cultivations with different media; sometimes it has almost the appearance of a micrococcus, at other times it shows a tendency to grow into short threads. In drop cultivations the same variety of forms was observed, but in no case was anything but oscillatory motion visible.

When grown on gelatine plates it produces surface expansions much resembling drops of milk.

Although it grows abundantly in the aqueous solution employed, it exerts no reducing action on the nitric acid.

Bacillus scissus.—In form this organism much resembles *Bacillus prodigiosus.* In no case were spores observed. In drop cultivations it is seen to be very motile.

It produces pale light green surface expansions on gelatine plates which, under a low power (× 100 diameters), are seen to be of fine granular texture, the edge being much frayed out.

In tubes the gelatine and agar-agar become tinted green.

It powerfully reduces nitrates to nitrites in the solution employed.

Of the above, the first nine were derived from water, whilst the remaining three were obtained from garden soil.

The original descriptions are illustrated by drawings of the various micro-organisms as seen in microscopic preparations, and of the appearances to which they give rise in gelatine-plate and other cultivations.

II. "Further Observations on the Electromotive Properties of the Electrical Organ of *Torpedo marmorata.*" By FRANCIS GOTCH, M.A. Oxon., B.A., B.Sc. London. Communicated by Prof. J. BURDON SANDERSON, F.R.S. Received February 23, 1888.

(Abstract.)

In the present memoir the author details the results of further observations as to the electromotive properties of the electrical organ of Torpedo, the experiments being carried out in October, 1887, at the laboratory of the Société Scientifique d'Arcachon.

I. The first part of the work deals entirely with the phenomena of "irreciprocal conduction" in the organ of Torpedo, as described by du Bois-Reymond.

From du Bois-Reymond's experiments it would appear that the organ possesses the remarkable property of conducting an intense current of short duration, led lengthwise through its columns, better when the current is directed from its ventral to its dorsal surface than when directed the reverse way. The former direction coincides with that of the current of the shock of the organ, and is therefore termed by him "homodromous," the latter being opposite in direction, is termed "heterodromous." The evidence rests upon the value of the galvanometric deflections obtained when both currents are allowed to traverse a strip of organ and a galvanometric circuit. The deflections are markedly unequal, particularly when induced currents are used, the homodromous effect being always much greater than the